

electrochemical impulses firing off in your brain while you sleep. Fourth is one of many studies that have influenced traditional psychological thinking by making a case *against* the widespread belief that hypnosis is a unique and powerful altered state of consciousness. This last study offers evidence suggesting that hypnotized people are no different from normally awake people—they are just a bit more motivated to behave in certain ways.

### Reading 5: TAKE A LONG LOOK

Fantz, R. L. (1961). The origin of form perception. *Scientific American*, 204(May), 61–72.

If you want to know about other people's perceptions of the world around them, an easy way to find out is to ask them. Depending, of course, on exactly what you ask, they will often tell you. But have you ever tried to ask this of an infant? As much as infants may seem, at times, to be trying to tell you what they are thinking and perceiving, they cannot; they can't talk; they probably could not tell you very much if they could; and, most likely, they couldn't even understand your question!

If you have had the opportunity to spend time around infants (and you all likely have to varying degrees), you may have often thought to yourself, "I wonder what this baby is thinking!" or "If only this baby could talk . . ." Unfortunately, that's not going to happen (John Travolta's series of *Look Who's Talking* movies aside). But psychologists' interest in studying and understanding infants has been a top priority throughout psychology's history (this book contains seven studies that have focused on infants).

However, in Robert Fantz's discoveries that we will discuss in this chapter, the questions that plagued the researchers were "How can we study an infant's cognitive processes?" "How can we catch a real glimpse inside very young babies' brains to see what might be going on, what they are perceiving, and how much they really understand?"

In the 1950s, Robert L. Fantz, a psychologist at Western Reserve University in Cleveland (now, Case Western Reserve University), noticed something very interesting about infants; however, these were not human infants but newly hatched chicks—that's right: chickens. Fantz reported that almost immediately upon breaking out of their shell, chicks perceive their environment well enough to begin searching and pecking for food. (See "Watch Out for the Visual Cliff!" in the previous group of readings for more about the perceptual talents of chicks.) This suggested to Fantz that chicks, in some ways, actually have superior perceptual abilities than human infants, making the chicks ideal subjects for research in this area. That said, it is important to note that when psychologists study nonhuman animals, their ultimate goal is to apply what they learn to our understanding of *human* behavior, but we will further discuss that issue later.

### THEORETICAL PROPOSITIONS

Prior to Fantz's studies, research had clearly demonstrated that human infants are able to perceive the world around them in some rudimentary ways, such as the ability to see light, discriminate basic colors, and detect movement. However, as Fantz pointed out, "It has often been argued that they cannot respond to such stimuli as shape, pattern, size, or solidity; in short, they cannot perceive *form*" (p. 66). But Fantz was skeptical of this argument, so in the late 1950s and early 1960s he set about developing a new research technique that would allow researchers to study in greater detail what infants can perceive; to pinpoint when perceptual skills develop; and to determine the degree of complexity of their perceptual skills. He proposed that human infants, from the moment of birth, not entirely unlike newly hatched chicks, are actually able to perceive various forms, and this can be demonstrated by observing how babies "analyze" their world—that is, *what* they look at and for *how long* they look at it. This method of studying infants' mental abilities, called *preferential looking*, swept through the psychology world and began a revolution, that continues today, into understanding the minds of infants.

### METHOD

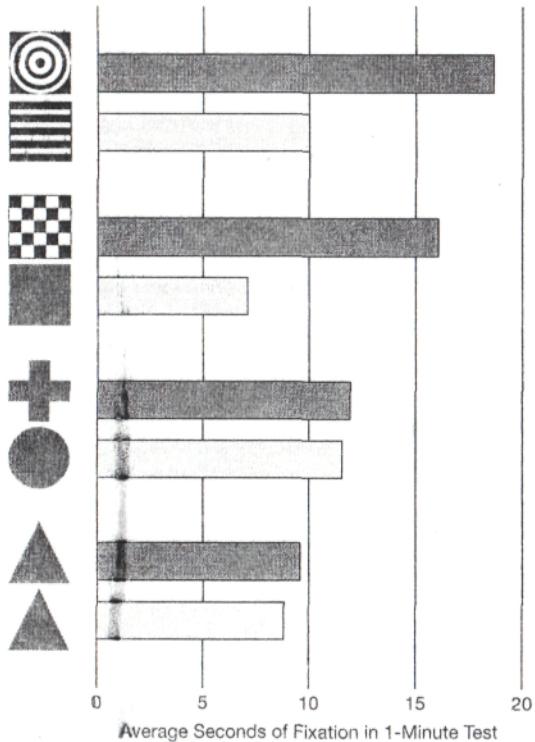
It wasn't difficult for Fantz to demonstrate some of what newly hatched chicks could and could not perceive. Fantz simply presented the chicks, before they had any experience pecking for real food, with objects of different shapes and sizes and recorded how often they pecked at each one. They pecked significantly more often at round shapes versus pyramid shapes; circles more than triangles; spheres more than flat disks; and when shapes of various sizes of circles were presented, they preferred those that were about  $\frac{1}{8}$  inch in diameter over larger or smaller sizes. Without any previous learning, chicks were able to perceive form, and they clearly preferred shapes most like potential food: seeds or grain.

Fantz expressed in his article what you are probably thinking right now: "Of course, what holds true for birds does not necessarily apply to human beings" (p. 67). He considered the possibility that this innate ability in birds to perceive form (and this is true of many bird species) may not have developed during the evolution of primates (including humans), or that perhaps primates acquire such abilities only after a period of development or learning following birth. So, when Fantz turned his attention to primate infants, he needed a new research method because, obviously, primate infants do not peck at anything, and they don't have the motor development to do so even if they are so inclined (which they aren't because infants are not terribly fond of grain and seeds).

Infants do engage in one behavior, however, that might allow them to be tested in a similar way to the chicks: they *stare* at things. If Fantz could figure out a way to see if they stare at some forms predictably more often or longer than others, the only explanation would be that they could tell the difference,

that they could perceive form. Working at first with infant chimpanzees, the primate genetically most closely related to humans, Fantz and his associates developed what he called a "looking chamber," which was basically a padded, comfortable bassinette inside of a large, plain box. In the top panel of the box were two openings for presenting objects to the infants and portholes allowing the researchers to observe the looking behavior of the infants. When the researchers ascertained that infant chimps appeared to show a systematic preference for certain objects over others (determined by duration of staring), they applied the same basic techniques to studying human babies.

The researchers did nothing to interfere with the babies' usual schedule or activities but simply placed the infants into the comfortable, padded viewing box and presented various pairs of object for them to look at. The infants ranged in age from 1 to 15 weeks of age. The stimuli presented to the babies included solid and textured disks; spheres; an oval with a human face; an oval with the features of a human face jumbled up; and shapes and patterns of varying complexity (see Figure 5-1). The researchers revealed the objects in various paired combinations and observed the total amount of time during each 1-minute trial the infants spent staring at the different pairs of objects, as well as which object within each pair they "preferred" (stared at longer). Their findings provided powerful evidence that babies of all ages possess the ability to perceive and discriminate among diverse forms.



**FIGURE 5-1** Infants' interest in form pairs as a function of average looking time for 220 tests. (Source: Fantz, 1961, p. 70.)

## RESULTS

For their first round of testing, the babies saw pairs of various black-and-white test patterns, including a square with horizontal stripes and a square with a bull's-eye; a checkerboard and a plain, no-pattern square; a wide plus-sign and a circle; and a pair of identical triangles as control stimuli. The results are graphically illustrated in Figure 5-1. Clearly the infants "preferred" the forms with the greatest complexity (the bull's-eye, stripes, and checkerboard). This degree of preference was the same, *regardless of the infant's age*, which indicates that the ability to discriminate among these forms is innate, present at birth. Beginning at approximately 8 weeks of age, the infants preferred the bull's-eye to the stripes and the checkerboard to the plain square. This time delay implies that either some learning has occurred in those 2 months or that maturation of the brain and/or visual system accounted for the change.

As interesting as these findings were, an important link between the infants' abilities and the earlier studies of the chicks was still missing. If human infants are born with an unlearned, natural ability to discriminate form, we must ask why. For chicks, the answer appears rather straightforward: they perceive the forms that allow them to find nourishment and to survive. How could such an innate ability to perceive specific forms have survival value for human infants? Maybe it is for a similar reason. Fantz wrote:

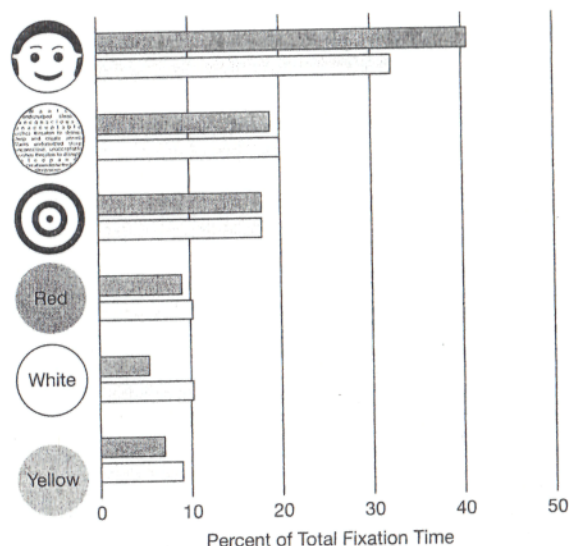
In the world of the infant, people have an importance that is perhaps comparable to the importance of grain in the chick's world. Facial pattern is the most distinctive aspect of a person . . . for distinguishing a human being from other objects and identifying him. So, a facelike pattern might be expected to bring out selective perception in an infant if anything could (p. 70).

In other words, human infants do not depend upon form perception for nourishment and survival; they depend on other *people* to care for them. Just as chicks can perceive specific shapes best, it would make sense that infants' perceptual tendencies should favor the human face. And it does.

Fantz's team presented 49 infants between 4 days and 6 months old with three identically sized oval disks. One was painted with the features of a human face, another with those same features scrambled, and the third, the control disk, an oval with just a patch of black at one end equal to the total area of the facial features on the other two disks (see Figure 5-2). The infants



**FIGURE 5-2** Fantz's Facial Figure Test. Infants preferred A over B, and strongly preferred A and B over C. (Source: Fantz, 1961, p. 72)



**FIGURE 5-3** Infants' looking time for patterns and colors (black bars = 8–12 months; grey bars = over 12 months of age). (Source: Fantz, 1961, p. 72.)

clearly showed greater interest in the ovals with the facial features and stared at them intently while virtually ignoring the control oval. Moreover, this preference was approximately the same strength for all infants *regardless of age*, demonstrating again that basic form perception is present at birth and ruling out a learning or developmental factor.

In the final study reported in this article, the researchers tested the human infants again for their ability to recognize facial forms. The infants were presented with six flat disks, each 6 inches in diameter with the following designs: (1) a human face; (2) a bull's-eye; (3) a random fragment of a printed page (such as a newspaper or textbook); (4) entirely red; (5) entirely fluorescent yellow; and (6) plain white. The time of the infants' first look at each disk was recorded. Which one do you think they looked at the most? If you said "the face," you are correct; they gazed at the human face disk far more than any other form or color (see Figure 5-3).

### SUBSEQUENT RESEARCH AND RECENT APPLICATIONS

This study, like so many in this book, significantly changed psychology for two reasons: the groundbreaking discoveries and the method the researcher developed to make those discoveries possible. Until the middle of the 20th century, many behavioral and biomedical researchers assumed that babies were born with few if any perceptual or sensory abilities and that they developed or learned most, if not all, of these skills as they interacted with their environment over time. This idea of the psychologically "empty" newborn was rela-

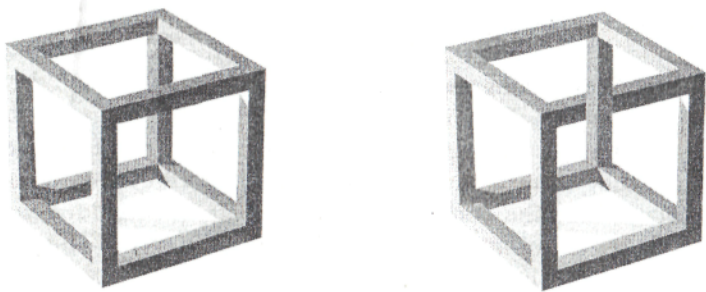
tively easy to accept because we did not, at the time, possess the necessary research methodologies to reveal very young infants' true capabilities. Fantz gave us preferential-looking methods that, quite literally, opened the doors to the mind of the infant. This method is used so commonly today that it is to psychology what a microscope is to biology: one of the first tools researchers turn to when they want to study how babies think. Of course, the discovery that infants come into the world with various perceptual skills does not reduce the importance of learning and development. But the *inborn* skills researchers have discovered using Fantz's methods appear to set the stage for an infant's future survival and growth. As Fantz points out:

Innate knowledge of the environment is demonstrated by the preference of newly hatched chicks for forms likely to be edible and by the interest of young infants in kinds of forms that will later aid in object recognition, social responsiveness, and spatial orientation. This primitive knowledge provides a foundation for the vast accumulation of knowledge through experience. (p. 72)

Fantz's discoveries ignited a research revolution into the perceptual abilities of infants. You can see the influence of Fantz's methodological ingenuity throughout the fields of developmental and cognitive psychology. For example, some of the leading researchers in the world in the area of infant cognition, such as Renee Baillargeon at the University of Illinois's Infant Cognition Lab and Elizabeth Spelke at Harvard's Laboratory for Developmental Studies, have made extensive use of Fantz's preference-looking research strategies in many studies (see Talbot, 2006, for a review of this work). In addition, Fantz's work helped clarify when and how well babies can perceive depth and drop-offs as studied in greater detail by Gibson and Walk in their classic research incorporating the visual cliff (see Chapter I).

Probably the most important extension of Fantz's work is credited to Frances Horowitz at the University of Kansas, who discovered that in addition to preferential looking, babies also become bored seeing the same stimulus over and over (Horowitz, & Paden et al., 1972). When you show infants a novel visual pattern (such as those used in Fantz's studies), they gaze at it for a given amount of time, but as you repeatedly present the same stimulus, the amount of time they look predictably decreases. This is called *habituation*. If you then change or alter the pattern, their interest appears to revive and they look at it longer, a response known as *dishabituation*. By combining preferential looking, habituation, and dishabituation methodologies, researchers can now learn a great deal about what very young infants, even newborns, "know" about their world.

For example, in a recent study, researchers wanted to see when humans acquire the ability to distinguish between "possible" objects and "impossible" objects (Shuwarai, Albert, & Johnson, 2007). You undoubtedly have seen so-called impossible objects that we often refer to as optical illusions. Figure 5-4 exemplifies the difference between a possible and impossible object. You looked longer at the impossible one, didn't you? So do babies. Using preferential-looking and duration-of-gaze methods, the researchers found that infants as young as 4 months old indicate an awareness of the difference in that they stared at the



**FIGURE 5-4** Babies can distinguish between a possible (a) and impossible (b) object at 4 months old.

impossible object longer, as if to say, “I can see something’s wrong with this object and I need to try to figure it out!”

This is just a sample of hundreds of studies conducted every year by developmental psychologists and other behavioral scientists whose fundamental methodologies rest on Robert Fantz’s discoveries. These methods are allowing us to peek inside the minds of infants as never before to see what they perceive and how they think. Virtually every time we take another look, we discover that they are “smarter” and perceive more of their world than we ever expected.

- Horowitz, F. D., Paden, L., Bhana, K., & Self, P. (1972). An infant-controlled procedure for studying infant visual fixations. *Developmental Psychology*, 7, 90.
- Shuwairi, S., Albert, M., & Johnson, S. (2007). Discrimination of possible and impossible objects in infancy. *Psychological Science*, 18(4), 303–307.
- Talbot, M. (2006, September 4). The baby lab. *The New Yorker*, 82(27), 91–101.

## Reading 6: TO SLEEP, NO DOUBT TO DREAM . . .

Aserinsky, E., & Kleitman, N. (1953). Regularly occurring periods of eye mobility and concomitant phenomena during sleep. *Science*, 118, 273–274. Dement, W. (1960). The effect of dream deprivation. *Science*, 131, 1705–1707.

As you can see, this section is somewhat different from the others in that *two* articles are discussed; this is so because the first study discovered a basic phenomenon about sleeping and dreaming that made the second study possible. The primary focus is William Dement’s work on dream deprivation, but to prepare you for that, Aserinsky’s findings must be addressed first.

In 1952, Eugene Aserinsky, although a graduate student, was studying sleep. Part of his research involved observing sleeping infants. He noticed that as these infants slept, active eye movements occurred periodically. During the remainder of the night, only occasional slow, rolling eye movements occurred. He theorized that these periods of active eye movements might be associated with dreaming. However, infants could not tell him whether they had been dreaming or not. To test this idea, he expanded his research to include adults.

Aserinsky and his coauthor, Nathaniel Kleitman, employed 20 normal adults to serve as participants. Sensitive electronic measuring devices were connected by electrodes to the muscles around the eyes of these participants. The leads from these electrodes stretched into the next room, where the participants’ sleep could be monitored. The participants were then allowed to fall asleep normally (participants participated on more than one night each). During the night, participants were awakened and interrogated, either during periods of eye activity or during periods when little or no eye movement was observed. The idea was to wake the participants and ask them if they had been dreaming and if they could remember the content of the dream. The results were quite revealing.

For all the participants combined, a total of 27 awakenings were done during periods of sleep accompanied by rapid eye movements. Of these, 20 reported detailed visual dreams. The other 7 reported “the feeling of having dreamed” but could not recall the content in detail. During periods of no eye movement, 23 awakenings were instigated; in 19 of these instances, the participants did not report any dreaming, while in the other four, the participants felt vaguely as if they might have been dreaming, but they were not able to describe any dreams. On some occasions, participants were allowed to sleep through the night uninterrupted. It was found that the latter group experienced between three and four periods of eye activity during the average of 7 hours of sleep.

Although it may not have seemed so remarkable at the time, Aserinsky had discovered what is very familiar to most of us now: rapid eye movement (REM) sleep, or dreaming sleep. From his discovery grew a huge body of research on sleep and dreaming that continues to expand. Over the years, as research methods and physiological recording devices have become more sophisticated, we have been able to refine Aserinsky’s findings and unlock many of the mysteries of sleep.

For example, we now know that after you fall asleep, you sleep in four stages, beginning with the lightest sleep (Stage 1) and progressing into deeper and deeper stages. After you reach the deepest stage (Stage 4), you begin to move back up through the stages: your sleep becomes lighter and lighter. As you approach Stage 1 again, you enter REM, which is a very different kind of sleep. You do most of your dreaming during REM sleep. However, contrary to popular belief, research has revealed that you do not move around very much during REM. Your body is immobilized by electrochemical messages from your brain that paralyze your muscles. This is most likely an evolutionary survival mechanism that prevents you from acting out your dreams and possibly injuring yourself or worse.

Following a short period in REM, you proceed back into the four stages of sleep called non-rapid-eye-movement sleep (NON-REM, or NREM). During the night, you cycle between NREM and REM about five or six times (your first REM period comes about 90 minutes after falling asleep), with NREM becoming shorter and REM becoming longer (thereby causing you to dream more toward morning). (By the way, everyone dreams. Although a small percentage of individuals never remember dreams, sleep research has determined that we all have them.)